The Role of Data Warehousing in Business Intelligence Systems to Support Rapid Decision-Making

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ABSTRACT

Business intelligence (BI) has developed into a completely new concept with the implementation of artificial intelligence (AI), providing simple and quick access to knowledge and information, data dashboards and visualizations, real-time scenarios, summary reports, and various tools for analysis of data, the web, and text. Systems used today for data management rely on data warehouses. These systems must combine, modify, and store vast amounts of data from many sources to enable analytics and business intelligence applications. Data warehouses have been built for many sectors to analyze their data and development. This research investigates the condition of data warehouses today and how they enhance business decision-making. This research will examine data warehouse design, implementation, management, and technical and economic problems. To give businesses an advantage in today's fiercely competitive market, the research will also examine how data warehouses affect firm productivity, including how well they can facilitate decision-making, improve data quality, and increase operational effectiveness. Two case studies will demonstrate how organizations have successfully integrated data warehouses with an applied qualitative methodology. Three business experts from the industry will speak as part of the research. After this research, a data warehouse structure that can be used across sectors will be created. The framework will also offer suggestions for implementing data warehouses in addition to data integration, governance, and quality control. This research completes gaps in understanding data warehouses and their application in business decision-making. The advantages and disadvantages of data warehouses, which improve business performance, will be examined in this study. Our study will enable businesses to implement better data management systems, improving business performance and offering them an edge over competitors.

Introduction

Business intelligence (BI) refers to a set of instruments, technologies, and practices used to analyze and present data so that businesses may make wise decisions for their organizations. Thanks to BI solutions, businesses may benefit from significant insights from massive amounts of data that would otherwise be difficult to understand. One of the critical components of a BI system is data warehousing, which gives central storage for massive volumes of data from several sources. Data warehousing is the process of extracting, converting, and loading (ETL) data from several sources into a principal repository. The data is organized to make it easy to retrieve, examine, and report on. Data warehousing provides a single source of truth for all organizational data, enabling more.

Data warehousing makes it possible to consolidate all of the data needed for reporting and analysis, two essential elements of BI systems. Data warehousing allows businesses to combine data from multiple places, like external data sources, transaction systems, and data obtained from various internal systems. Data warehousing offers many benefits for BI systems. The ability to combine data from several sources is the initial advantage of data warehousing. It is essential since it makes comprehending the organization's data more thoroughly possible. A consistent and uniform view of the data is also provided by data warehousing, which is essential for analysis and reporting.

Thirdly, data warehousing makes it possible to analyze past information, which is essential for spotting trends and making wise judgments.

Related Works

A research paper titled "The Study on Data Warehouse Design and Usage" by Dishek Mankad and Preyash Dholakia looks at how data warehouses are designed and used within the context of modern business intelligence study provides a comprehensive overview of data warehousing, outlining both its benefits and drawbacks. The authors discuss several aspects of data warehouse architecture, such as database design, indexing techniques, and data modeling techniques (Dishek Mankad & Dholakia, 2013).

They also go over the relevance of the quality of data and how to ensure that the data warehouse's content is accurate, consistent, and comprehensive. The study also looks at how data warehouses are applied in the banking, healthcare, and commerce sectors. It places a focus on using data warehouses to improve operational effectiveness, contributes to making informed choices, and get insights into consumer behavior. Additionally, the authors of this paper discuss the various ETL (extract, transform, load) tools, data visualization applications, and query optimization techniques that are available for data warehousing (Dishek Mankad & Dholakia, 2013).

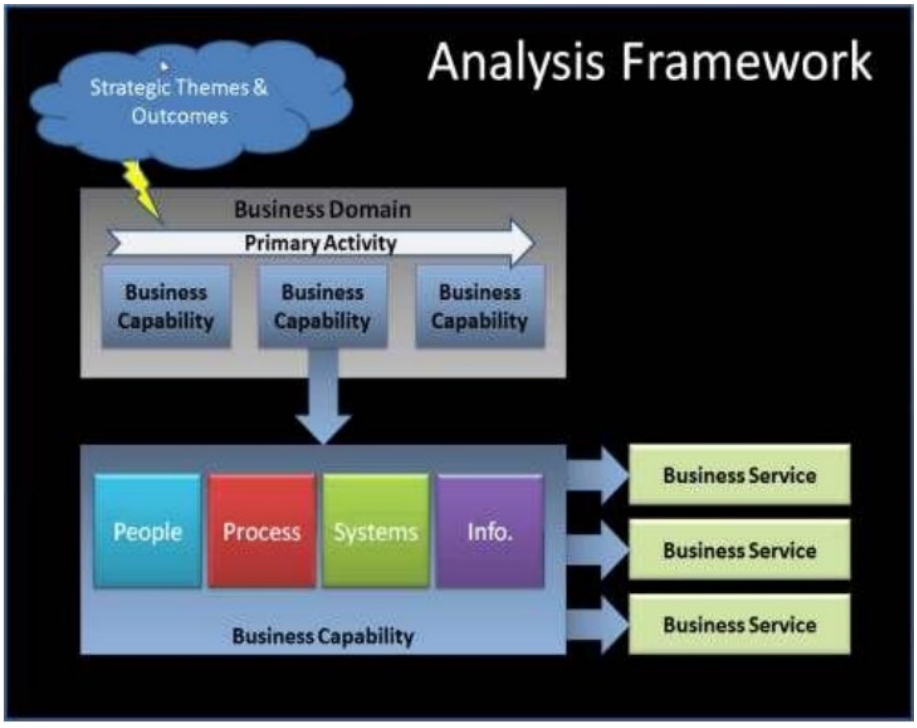

Figure 1. Analysis Framework (Dishek Mankad & Dholakia, 2013)

A critical review of data warehouses is presented in "A Critical Review of Data Warehouses" by Sachin Chaudhary, Devendra Prasad Murala, and V. K. Srivastav. The writers give a summary of the history, growth, and current state of data warehouses. The article also covers data warehousing elements like data sources, data entry, data

display, and data modification. These elements come with a lot of challenges, but the authors offer solutions to them (Chaudhary et al., 2011).

The research evaluates the benefits of data warehousing, such as improved decision-making, operational efficiency, and competitive edge. Additionally, it examines the negatives and risks of data warehousing, including issues with poor data quality, security risks, and high costs for execution. The authors also review new developments in data warehousing, including real-time data warehousing, cloud-based data warehousing, and big data analytics. They explain how these new technologies may be applied to improve the efficiency and usefulness of data warehousing systems (Chaudhary et al., 2011).

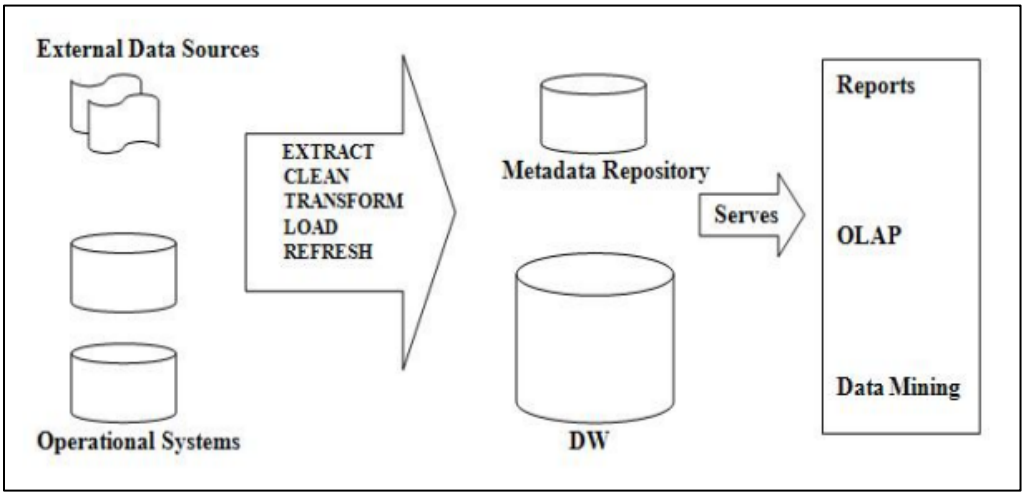

Figure 2. Data Warehouse Architecture (Chaudhary et al., 2011)

Nuno Silva's research paper, "Advancing Big Data Warehouses Management, Monitoring, and Performance," explores multiple monitoring and management strategies for massive data warehouses intending to enhance performance. The study extensively summarises firms' challenges when managing enormous data warehouses and investigates the various techniques used. Based on the report, big data warehouses must be addressed to achieve scalability, fault tolerance, and high availability (Silva, 2020).

The article also explores several technologies and techniques, including those for performance tuning, query optimization, and data profiling, that can be used to monitor substantial data warehouses. It looks into many strategies, such as load balancing, replication, and data segmentation, to boost the effectiveness of enormous data warehouses. The significance of real-time monitoring is emphasized, and it is discussed how monitoring may be utilized to spot bottlenecks in performance and other problems within massive data warehouses (Silva, 2020).

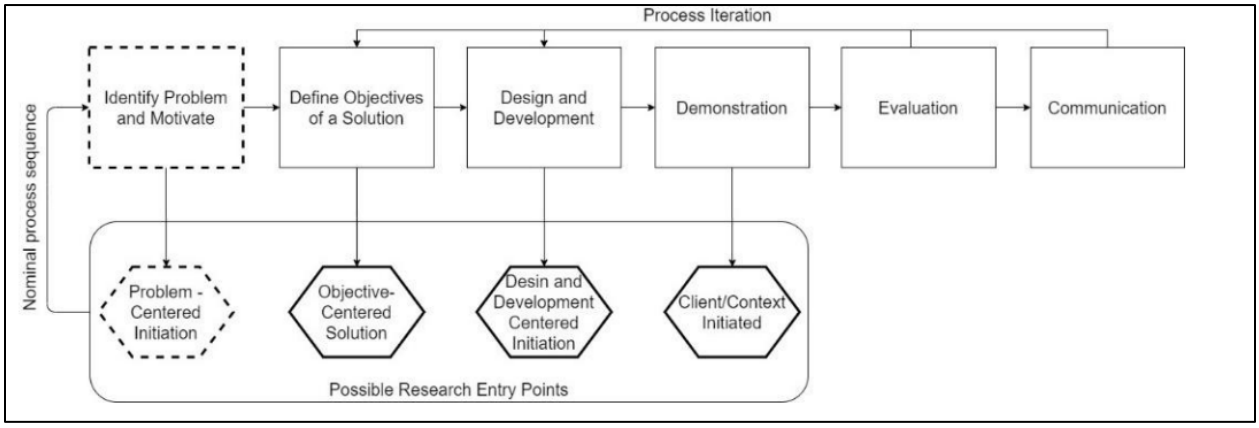

Figure 3. DSRM-IS process model (Silva, 2020)

Methods

Using qualitative research techniques, it is possible to examine how business intelligence systems use data warehousing to support speedy decision-making. These methods are appropriate because they enable researchers to look into the experiences, opinions, and perceptions of persons involved in creating, designing, and using these systems. Focus groups, interviews, and case studies are examples of qualitative research techniques that could be used.

Focus groups are a qualitative research technique that could be used to analyze data warehousing operations in business intelligence systems. Focus groups involve assembling a group of people who have common interests or perspectives on a given subject. In this case, researchers may gather an IT or business analyst focus group to talk about the benefits and cons of implementing a data warehousing system that aids in decision-making.

In-depth information from people creating and using business intelligence systems can be obtained through interviews. Stakeholders, including IT managers, business analysts, and data architects, can be interviewed. By speaking with various stakeholders, researchers might learn how the data warehousing system supports business decision-making at different levels.

Case studies are the ultimate method for examining the goal of data warehousing in business intelligence systems. It might be essential to achieve this by looking at system data, talking about significant players, and watching decision-making processes. Researchers could pick a few firms that have set up data warehousing systems and carefully analyze how the systems have affected decision-making processes.

Design and Implementation

It is impossible to exaggerate the value of data warehousing in today's business intelligence systems. It provides a method for keeping data from several sources accessible and arranged in an optimum form for reporting and analysis. This study will discuss the function of data warehousing in business intelligence systems and how it could support prompt decision-making.

The Design of a Data Warehouse

The most important task that must be done to create a business intelligence system is to design a data warehouse. There are many steps required in order to fully accomplish this which includes Searching for sources of information that will be analyzed in order to develop an architecture that preserves the data along with its processing and recovery.

Data Sources: One of the most crucial steps in constructing a warehouse, is selecting the proper data sources to use. The data sources can either be organized or unorganized sources such as financial databases, different platforms of social media, log records, and other sources. It is critical to ensure that the data sources selected are consistent and compatible with the data warehouse architecture in order to build a data warehouse.

Data modeling: After specifying the appropriate data sources the data needs to be modelled. This involves analyzing and reporting the data which will be transformed to be suitable for that purpose. The data attributes and entities are determined by specifying their linkages and creating a schema to organize the data during the modelling process

Data Warehouse Architecture: Developing an architecture is the last step in creating the data warehouse, this allows storage, data processing, and retrieval. It is necessary that the architecture is able to handle and accept huge amounts of data in a speedy and quick reporting manner for querying.

Implementing a Data Warehouse

The necessary infrastructure must be implemented, data must be loaded, and reporting and analysis instruments must be created before a data warehouse can be used.

Deployment: Deploying the architecture is the first stage in operating a data warehouse. A database management system, hardware and software infrastructure, safety, and access control mechanisms will all be deployed.

Data Loading: After the architecture has been implemented, the data needs to be stored in the warehouse. This process can be tedious and difficult when working with many data. Several techniques can load data into a data warehouse, including batch processing, incremental processing, and immediate processing.

Reporting and Analysis Tools: Developing analytical and reporting tools that allow users access to the data kept in the warehouse is the last stage in implementing a data warehouse. Scorecards, dashboards, data visualization tools, and ad hoc reporting tools are examples of these tools.

Proposed Framework

The suggested framework for data warehousing, which specifies the design of a data warehouse system, comprises common principles and recommendations. Using this framework, data warehouses are created to efficiently store, process, and retrieve information. It is typical for the suggested framework for data warehousing to mention data sources, staging area (ETL tools), data warehouse, and users. Due to the interaction between these components, it is easier for users to retrieve the data they need because a complete and integrated picture is created of the information (Simic, 2020).

It is possible to present the data from the data source area in various ways. The steps of ETL are extract, transform, and load. Before entering the data warehouse, data from multiple formats is extracted using ETL tools and quality-checked in the staging area. It needs to be cleaned up and arranged before combining data from other sources into one database (Simic, 2020).

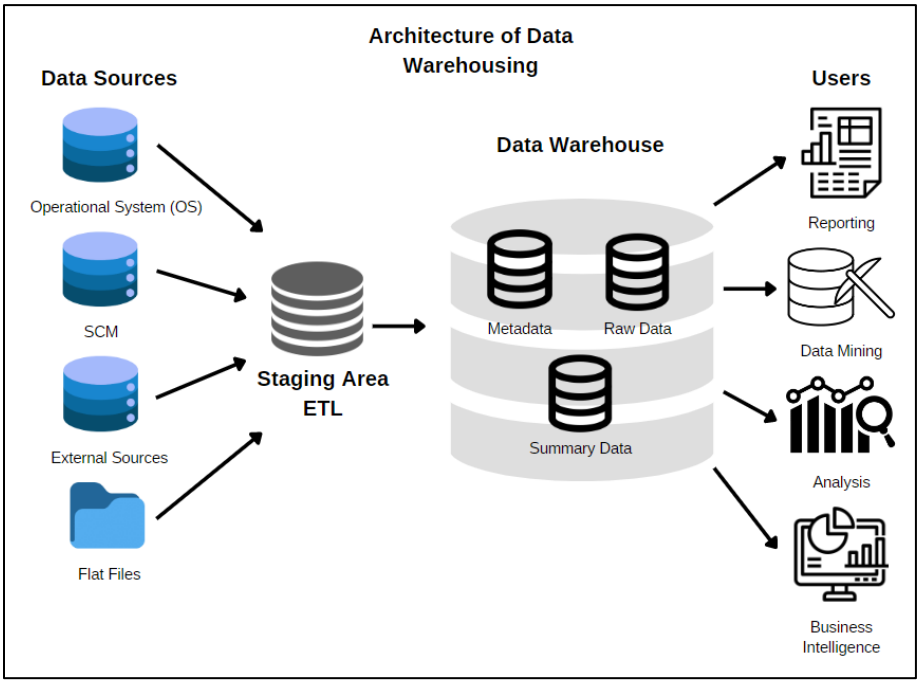

Figure 4. Architecture of Data Warehousing

Recommendations

Business intelligence solutions depend on data warehousing to aid in timely decision-making. To maximize the benefits of data warehousing in business intelligence, consider the following suggestions:

Develop a thorough awareness of the expectations of the business: Before building a data warehouse, it is essential to understand the precise business requirements under which the system will function. This information will ensure that the data warehouse supports decision-making and complements the organization's overarching plan more straightforwardly. Create a functional data architecture because that is the foundation of a data warehouse. To manage, store, and analyze data from various sources, create an attractive and flexible data architecture. Make sure the data is organized and presented for easy retrieval.

Make the proper tool selections for data integration: Data integration techniques are essential for transferring data from many sources to the data warehouse. Find the tools that extract, modify, and load data from different sources.

Ensuring consistency and quality of the data: The correctness and dependability of the data a data warehouse stores significantly impact its performance. Implement measures to ensure the data's consistency, correctness, and comprehensiveness. Use data profiling and cleaning tools to identify and resolve any issues with data quality.

Adopt the necessary security measures: Data warehousing systems store important data; as a result, appropriate security measures must be put in place to prevent unauthorized access, including encryption, user access controls, and other security measures to prevent unauthorized use and data theft.

Provide user-friendly BI tools: Data warehousing aims to give decision-makers quick and easy access to relevant data. Gives customers the ability to use user-friendly BI tools to perform ad hoc analysis, create reports, and show data in various ways. The BI tools should also be easy to use and straightforward for non-technical individuals.

Conclusion

In summary, data warehousing is critical to business intelligence systems because it provides a trustworthy, consolidated source of information that speeds up decision-making. With data warehousing, businesses can obtain crucial insights that could hasten decision-making by making data processing, visualization, and reporting more accessible and practical. By integrating data from many sources and putting it into a standard format, data warehousing assists businesses in increasing data accessibility, lowering data complexity, and improving data quality. By identifying patterns, trends, and linkages in their data, decision-makers can better understand their business operations, markets, and clients.

Data warehousing will become increasingly important as data volume and complexity increase, making it a necessary investment for any company trying to stay competitive in the digital era. Modern business intelligence systems that support speedy decision-making encourage a culture of data-driven decision-making and lead to company success; all depend on data warehousing. Additionally, data warehousing lays the foundation for cutting-edge analytics techniques like predictive modelling and machine learning. These techniques help companies spot threats and opportunities, predict future trends and events, and streamline operating processes.

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